CLAIMS

1. A magnetic detection device comprising:

a first magnetic core of a soft magnetic film,

a conductive wire formed on said first magnetic core at a portion thereof, and

a second magnetic core of a soft magnetic film formed on said first magnetic core so as to hold said conductive wire therebetween, the area of the cross-section perpendicular to a magnetic path being partially different.

2. A magnetic detection device comprising:

a first magnetic core of a soft magnetic film, the area of the cross-section perpendicular to a magnetic path being partially different,

a conductive wire formed on said first magnetic core at a portion thereof, and

a second magnetic core of a soft magnetic film formed on said first magnetic core so as to hold said conductive wire therebetween, the area of the cross-section perpendicular to a magnetic path being made smaller in the vicinities of the fringe portions of said conductive wire than that of the other portion.

3. A magnetic detection device comprising:

a first magnetic core of a soft magnetic film,

a conductive wire formed on said first magnetic core at a portion thereof, and

a second magnetic core of a soft magnetic film formed on said first magnetic core so as to hold said conductive wire therebetween, the thickness of said second magnetic core being smaller than that of said first magnetic core.

4. A magnetic detection device comprising:

a first magnetic core of a soft magnetic film,

a conductive wire formed on said first magnetic core at a portion thereof, and

a second magnetic core of a soft magnetic film formed on said first magnetic core so as to hold said conductive wire therebetween, the thickness of said second magnetic core being larger than that of said first soft magnetic core.

5. A magnetic detection device in accordance with claim 1 or 2, wherein the width of at least one of said first and second magnetic cores is made smaller in the vicinity of said conductive wire.

6. A magnetic detection device in accordance with claim 1 or 2, wherein said second magnetic core has a depressed portion or a hole in a region including said conductive wire to decrease the area of the cross-section perpendicular to a magnetic path of said second magnetic core.

7. A magnetic detection device in accordance with claim 1 or 2, wherein said conductive wire is held between said first and second magnetic cores via insulation films.

8. A magnetic detection device in accordance with claim 1 or 2, wherein the ratio of the small portion and the large portion of the partially different cross-sectional areas of said first magnetic core and said second magnetic core is 3 to 4 or less.

9. A magnetic detection device in accordance with claim 1 or 2, wherein the thickness of at least one of said first and second magnetic cores is made smaller in the vicinity of said conductive wire.

10. A magnetic detection device in accordance with claim 1 or 2, wherein the thickness of

said conductive wire in the vicinities of the fringe portions thereof is made smaller.

11. A magnetic detection device in accordance with any one of claims 1, 2, 3 or 4, wherein the thickness of at least one of said first and second magnetic cores in a region thereof including said conductive wire is partially made smaller.

12. A magnetic detection device in accordance with claim 1 or 2, wherein grooves are formed so that the area of the cross-section perpendicular to a magnetic path of said second magnetic core at the circumference of said conductive wire is made smaller than that at the other portion.

13. A magnetic detection device in accordance with any one of claims 1 to 4, wherein said first magnetic core and said second magnetic core are insulated by an insulation layer in a region including said conductive wire.

14. A magnetic detection device in accordance with claim 1 or 2, wherein the end regions of said first magnetic core have a two-layer structure.

15. A magnetic detection device in accordance with any one of claims 1 to 4, wherein the thickness of said conductive wire is larger than the thickness of one of said first magnetic core and said second magnetic core.

16. A magnetic detection device in accordance with claim 15, wherein the thickness of said conductive wire is larger than the thickness of said second magnetic core.

17. A magnetic detection device in accordance with claim 15 or 16, wherein the ratio (thickness/length) of the thickness of said conductive wire to the length thereof in a direction parallel with the direction of a magnetic field to be detected is 1/4 or more.

18. A magnetic detection device comprising:

a first conductive wire formed in a predetermined region on one face of a first magnetic core of a soft magnetic film,

a second conductive wire formed in a region opposed to said first conductive wire on the other face of said first magnetic core,

a second magnetic core formed on said one face of said first magnetic core and on said first conductive wire, and

a third magnetic core formed on said other face of said first magnetic core and on said second conductive wire.

19. A magnetic detection device in accordance with claim 18, wherein the areas of the respective cross-sections perpendicular to magnetic paths of said second and third magnetic cores are partially different.

20. A magnetic detection device in accordance with claim 18, wherein said first and second conductive wires contact said respective first, second and third magnetic cores via respective insulation films.

21. A magnetic detection device in accordance with claim 19, wherein the ratio of the thickness of a thin portion having a small cross-sectional area and the thickness of a thick portion having a large cross-sectional area in said second and third magnetic cores is 3 to 4 or less.

22. A magnetic detection device in accordance with claim 18, wherein the vicinities of portions opposed to the circumferences of said first and second conductive wires of said second and third magnetic cores are made thinner than the other portions.

23. A magnetic detection device in accordance with claim 18, wherein portions opposed to said first and second conductive wires of said second and third magnetic cores are made thinner than the other portions.

24. A magnetic detection device in accordance with claim 18, wherein said second and third magnetic cores have grooves at portions opposed to said first and second conductive wires.

25. A magnetic detection device in accordance with claim 18, wherein the regions, at the circumferences of said first and second conductive wires, of said second and third magnetic cores are removed.

26. A magnetic detection device in accordance with claim 18, wherein said first magnetic

core is made thinner than said second and third magnetic cores.

27. A magnetic detection device in accordance with claim 18, wherein the thicknesses of said first and second conductive wires are larger than the thicknesses of said second and third magnetic cores.

28. A magnetic detector comprising:

a first magnetic core of a soft magnetic film, the cross-sectional area of which is partially different,

a conductive wire formed on said first magnetic core at a portion thereof,

a second magnetic core of a soft magnetic film formed on said first magnetic core and said conductive wire so as to hold said conductive wire therebetween, the area of the cross-section perpendicular to a magnetic path of said second magnetic core being partially different,

magnetic bias means for applying a bias magnetic field in the direction parallel to the direction of a magnetic field to be detected to said first and second magnetic cores, and

an AC carrier signal generator for flowing

an AC current to said conductive wire in a direction perpendicular to said magnetic field to be detected.

29. A magnetic detector comprising:

a first conductive wire formed in a predetermined region on one face of a first magnetic core of a soft magnetic film,

a second conductive wire formed in a region opposed to said first conductive wire on the other face of said first magnetic core,

a second magnetic core of a soft magnetic film formed on said one face of said first magnetic core and on said first conductive wire, the area of the cross-section perpendicular to a magnetic path of said second magnetic core being partially different,

a third magnetic core made of a soft magnetic film and formed on said other face of said first magnetic core and on said second conductive wire, the area of the cross-section, perpendicular to a magnetic path, of which is partially different,

magnetic bias means for applying a bias magnetic field in the direction parallel to the direction of a magnetic field to be detected to said first, second and third magnetic cores, and

an AC carrier signal generator for flowing AC carrier currents to said first and second

conductive wires in a direction perpendicular to said detected magnetic field.

30. A magnetic detector in accordance with claim 29, wherein AC carrier currents having the same phase are let to flow through said first and second conductive wires, and DC currents having directions opposite to each other are let to flow through said first conductive wire and said second conductive wire, thereby applying a DC bias magnetic field.

31. A magnetic detector in accordance with claim 29, wherein one end of said first conductive wire is connected to one end of said second conductive wire so as to form a coil enclosing said first magnetic core.

32. A magnetic detector in accordance with claim 29, wherein AC carrier currents having phases opposite to each other are let to flow through said first conductive wire and said second conductive wire, and DC currents having directions opposite to each other are let to flow through said first conductive wire and said second conductive wire, thereby applying a DC bias magnetic field.

33. A magnetic detection device comprising:

a first magnetic core of a soft magnetic film having a nearly rectangular shape and formed on a nonmagnetic substrate,

a plurality of first conductive wires formed on said first magnetic core at predetermined intervals in a direction perpendicular to the longitudinal direction of said rectangular first magnetic core,

a second magnetic core of a soft magnetic film formed on said first magnetic core so as to hold said first conductive wires therebetween, the area of the cross-section perpendicular to a magnetic path being partially different, and

a plurality of second conductive wires for connecting said plurality of first conductive wires in series.

34. A magnetic detection device in accordance with claim 33, comprising a plurality of magnetic detection devices, each comprising:

a first magnetic core of a soft magnetic film having a nearly rectangular shape and formed on a nonmagnetic substrate,

a plurality of first conductive wires formed on said first magnetic core at predetermined intervals in a direction perpendicular to the longitudinal

direction of said rectangular first magnetic core,

a second magnetic core formed on said first magnetic core so as to hold said first conductive wires therebetween, the area of the cross-section perpendicular to a magnetic path of said second magnetic core being partially different, and

a plurality of second conductive wires for connecting said plurality of first conductive wires in series, therein

said plurality of magnetic detection devices are arranged in parallel with said longitudinal direction, and said first and second conductive wires of the respective detection devices are all connected in series.

35. A magnetic detection device comprising:

a plurality of first magnetic cores having a nearly rectangular shape and formed in parallel on a nonmagnetic substrate,

a plurality of first conductive wires formed on said plurality of first magnetic cores at predetermined intervals in a direction perpendicular to the longitudinal direction of said plurality of first magnetic cores,

second magnetic cores formed on said plurality of first magnetic cores so as to hold said

first conductive wires therebetween, the areas of the cross-sections perpendicular to magnetic paths being partially different, and

second conductive wires for connecting all of said plurality of first conductive wires in series.

36. A magnetic detection device in accordance with claim 35, wherein the thicknesses of said second magnetic cores in the vicinities of said first conductive wires are made smaller.

37. A magnetic detection device in accordance with claim 35, wherein among said plurality of first and second magnetic cores having a nearly rectangular shape and formed in parallel on said nonmagnetic substrate, those disposed at both end portions are made shorter than those disposed at the central portion.

38. A magnetic detection device in accordance with any one of claims 33 to 35, wherein said second conductive wires are conductive films formed on said second magnetic core.

39. A magnetic detection device in accordance with any one of claims 33 to 35, wherein

insulation films are provided between said first magnetic core and said first conductive wire, between said first conductive wire and said second magnetic core and between said second magnetic core and said second conductive wire.

40. A method of producing a magnetic detection device, comprising:

a step of forming a first magnetic core by forming a soft magnetic film in a desired pattern on a nonmagnetic substrate,

a step of forming a conductive wire by forming a conductive film in a desired pattern in a predetermined region of said first magnetic core,

a step of forming a second magnetic core by forming a soft magnetic film in a desired pattern on said first magnetic core and said conductive wire, and

a step of making the thickness of said second magnetic core smaller at predetermined portions thereof.

41. A method of producing a magnetic detection device, comprising:

a step of forming a first magnetic core by forming a soft magnetic film in a desired pattern on a nonmagnetic substrate,

a step of forming a first insulation film by forming a nonmagnetic and insulating film in a desired pattern on said first magnetic core,

a step of forming a conductive wire by forming a conductive film in a desired pattern on said first insulation film,

a step of forming a second insulation film made of a nonmagnetic and insulating film on said conductive wire,

a step of forming a second magnetic core, the cross-sectional area of which is partially different, by forming a soft magnetic film in a desired pattern on said first insulation film and said second insulation film, and

a step of making the end portions of said first magnetic core thicker by forming soft magnetic films in the end regions of said first magnetic core.